

with which this takes place seems wonderful and to me somewhat analogous to crystallization in inorganic matter. If the elytra are examined from their upper surface, the difference between the larger punctures surrounding the spots and those of the ground-colour is very marked, the latter being irregularly and the others regularly placed; but if the elytra are removed and examined from the inner side, a thin layer of skin covers the entire surface, but the punctures shine through it and seem of nearly equal size and much more numerous. I may further mention, that all the spots or bands on the upper surface seem slightly convex and show rarely any punctures except round their margins. These are all the observations I am able to record; and I must leave to anatomists to form any conclusions, if such are possible, as to the way in which nature has worked here, and whether we could obtain any clue by examining the insect in its native place, when immature and in process of formation, so as to get some idea how colour, so distinct from punctuation, can influence the latter or the reverse, when this is apparently the case in so exceptional an instance as the present. The subject itself is not new, having been noticed by Chapuis and myself some years ago, but I think it well to draw attention to it again, so that more observations may be made, if possible.

4. On the Oblique Septa ("Diaphragm" of Owen) in the Passerines and in some other Birds. By FRANK E. BEDDARD, M.A., F.R.S., Prosector to the Society, Examiner in Zoology and Comparative Anatomy to the University of London.

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The facts which I bring before the Society have been accumulating in my notebook for the last few years, and even now there are numbers of types of Passerine birds which I have not had, and may never have, the opportunity of examining. Less emphasis, therefore, must be laid upon such classificatory conclusions as I venture to bring forward, than upon the actual facts which I record. There are a certain number of desirable Passerine genera represented in the rich spirit stores of the Prosector's department, but not referred to in the present paper; I have thought it unwise to make any use of them, since fresh material is so essential for the proper study of delicate and transparent membranes.

The greater part of the present communication deals with the divergent structure of what Prof. Huxley<sup>1</sup> has termed the "*oblique septum*" in Passerine birds. I may therefore conveniently commence with a description of the normal arrangement of this structure, as it is seen for example in the Duck. And I avail myself of Prof. Huxley's own words<sup>2</sup>:—"The second so-

<sup>1</sup> "On the Respiratory Organs of *Apteryx*," P. Z. S. 1882.

<sup>2</sup> *Loc. cit.* p. 561.

called 'diaphragm' ('diaphragme thoraco-abdominal,' Sappey; 'diaphragmite thoraco-abdominal,' Milne-Edwards) is a more or less aponeurotic fibrous membrane, continuous with the ventral edge of the median dorsal septum and suspended by it, like the roof of a tent, across the thoraco-abdominal cavity. In the middle line, this *oblique septum* slopes downward and forward to the dorsal and anterior face of the pericardium, with which its fibres become firmly connected on their way to their attachment to the sternum. From the median line, the two halves of the oblique septum slope laterally and ventrally until they attach themselves to the parietes of the abdomen behind, to those of the thorax more anteriorly, and to the margins of the sternum in front."

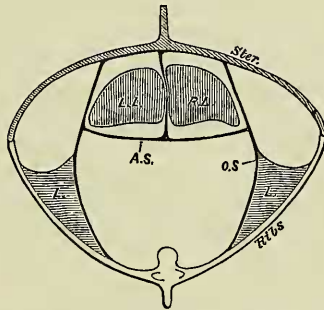
In fact, if we make a transverse section through a Duck or most other birds at the level of about the middle of the sternum, the appearances will be such as are diagrammatically represented in the accompanying drawing (fig. 1, p. 227). Four membranes are there visible—the intestines being left out of consideration for the purposes of simplification, and as not germane to the structures at present under discussion. The first of these is the falciform ligament, which divides the lobes of the liver and is attached below to the middle line of the sternum. Then there are the oblique septum (*O.S.*), attached below to the sternum laterally, and above to the parietes; and finally the horizontal septum (*A.S.*), which floors the two cavities containing the liver-lobes.

This arrangement, however, does not hold good for a number of Passerine birds; and it is possible—though I am not yet in a position to make a definite statement about the matter—that the arrangement which I am about to describe as characteristic of many Passerines will be found to be distinctive of the group. I commence with a somewhat detailed description of the oblique septa of a Crow (*Corvus capellanus*) (see fig. 2, p. 227). As I have dissected three examples of this bird, the following description will probably be found to be free from any record of abnormal conditions.

The right lobe of the liver is considerably larger than the left, and extends some way beyond the margin of the sternum, in fact about as far as to the end of the posterior intermediate air-sac. It is separated from the liver-lobe of the left side as usual by a vertically directed septum, the umbilical or falciform ligament; this falciform ligament is attached to the ventral parietes for a distance of about an inch—from the posterior end of the sternum to a point rather in front of that which corresponds to the posterior margin of the liver. *Anterior to the posterior edge of the sternum, the falciform ligament is not attached to that bone; it becomes fused with the two oblique septa, forming a roof over the liver-lobes in this region, which is separated by a wide interval from the internal surface of the sternum.*

The oblique septa are closely attached for a considerable distance to the liver-lobes, the adhesion being certainly not pathological.

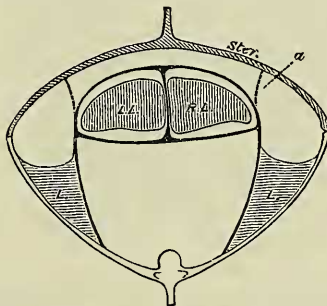
Fig. 1.



Diagrammatic transverse section through the thorax of a Duck.

*L., L.*, lungs; *L.L., R.L.*, left and right liver-lobes; *O.S.*, oblique septum; *A.S.*, horizontal septum.

Fig. 2.



Diagrammatic transverse section through the thorax of a Crow  
(*Corvus capellanus*).

*a*, rudiments of sternal attachment of oblique septum. The other  
lettering as in fig. 1.

At the posterior margin of the sternum the two oblique septa bend inward, and join each other in the middle, becoming here, as already mentioned, fused also with the umbilical ligament; anteriorly this roof formed by the oblique septa becomes continuous with the pericardium. The horizontally disposed roofing membrane formed by the union across the middle line of the two umbilical ligaments is, however, attached to the sternum on both sides for a short space by a membrane, somewhat slight and fenestrated (fig. 2, a, p. 227), which arises from the oblique septum just where it is bent over to assume a horizontal direction.

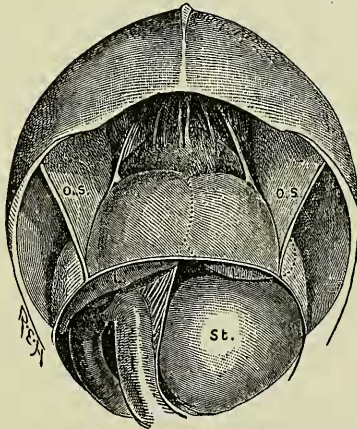
The floor of the hepatic cavity of the right side, whose roof and sides are formed of body-wall, oblique septum, and falciform ligament, is a transparent membrane, anteriorly closely attached to the liver; posteriorly it covers over body-cavity, being attached to oblique septum and to ventral parietes; on the left side of the body it is continuous with the floor of the left hepatic cavity, which has corresponding attachments to the oblique septum and parietes of its own side; it splits so as to surround the gizzard. It is the "horizontal septum," "pseud-epiploon," or "so-called omentum." It follows, therefore, that each liver-lobe in *Corvus capellanus* is contained in a separate cavity, the two being divided by the umbilical ligament; each of these cavities is considerably larger than the liver-mass which it encloses, extending back nearly as far as to the cloaca. It is, however, to the relationship between the oblique septa and the falciform ligament that I desire particularly to call attention in the above description. I find that this peculiar arrangement of the oblique septa and the falciform ligament is not only characteristic of *Corvus capellanus*, but also of other Crows and of other Passerines. The Raven and the Alpine Chough agree absolutely with *Corvus capellanus*; so too *Urocissa magnirostris*, *Paradisea minor*, *Pastor roseus*, Starling, *Gracula intermedia*, *Ptilonorhynchus violaceus*, *Vidua paradisica*, Spanish Blue Magpie, *Hyphantornis texta*, *Leucodioptron canorum*, *Sturnella ludoviciana*, *Sialia wilsoni*, *Turdus merula*, *Pitangus sulphuratus*, *Furnarius* sp., *Tanagra striata*, *Cardinalis virginianus*, *Fringilla teydea*, and a few others. In a specimen of the Rook (see fig. 3, p. 229) there is a slight difference, the oblique septa being split into two layers, one having the normal attachment, the other the Passerine.

In *Struthidea cinerea*, again, I observed a slight difference in the arrangement of these various septa coupled with a general agreement. The point of difference was that, in the specimen of this bird which I dissected there was on each side a thin transparent partition arising from the falciform ligament and attached to the oblique septum of its side. This membranous partition did not, as it perhaps might have been expected to do, shut off the liver from the posterior portion of the abdominal cavity; it arched over the liver with a semicircular free edge, one half of the liver being in front of it, the other behind.

Leaving aside the characteristics of *Struthidea* for a moment, I desire to direct attention to the general feature of such Passerines

as I have examined—both Acromyodian and Mesomyodian it should be observed—to the peculiarity which they show in the arrangement of the oblique septa. Another distinctive feature of Passerine anatomy is quite desirable. So far as we know at present, there is positively only one character which is absolutely distinctive of Passerine birds. That is, in the condition of the tendon of the *patagialis brevis* muscle as it was described some years since by the late Prof. Garrod<sup>1</sup>. Though it is perhaps easy enough to define the Passeres by a combination of characters, none of these characters are everywhere present. It is therefore of more importance than in some easily definable groups to add to this single character only wanting in the Pseudoscines (*Menura* and *Atrichia*) another which future research may possibly show to be more universal, and which is at any rate found in several genera widely separated from each other.

Fig. 3.



Abdominal and thoracic viscera of Rook displayed by removal of abdominal muscles.

St., stomach; L., liver; O.S., oblique septa. The lobes of the liver are covered by a membrane continuous with the dorsal part of the oblique septa.

This anatomical feature may therefore have a considerable systematic interest. Apart, however, from this, which requires still further proof, the conditions which obtain in the Passerine bird remind one in some degree of the Crocodile. The liver-lobes

<sup>1</sup> Coll. Papers, p. 356.

of that reptile are invested by a closely adherent membrane, which has been thus described by Prof. Huxley<sup>1</sup>:—"A fibrous expansion extends from the vertebral column over the anterior face of the stomach, the liver, and the dorsal and front aspect of the pericardium, to the sternum and the parietes of the thorax, separating the thoraco-abdominal space into a respiratory and a cardio-abdominal cavity, and representing the oblique septum of the bird." Both I<sup>2</sup> and Mr. G. W. Butler<sup>3</sup> have included in the comparison which Prof. Huxley thus made the omentum of the bird. But this does not interfere with the special likeness which the Passerine shows to the Crocodile, in that the representative of the oblique septum of other birds has not (as a rule) a ventral attachment on each side to the sternum, but that it forms a closely investing sheath to the liver-lobes; but it is very doubtful whether this resemblance is more than a superficial one. It is agreed on all hands that the Passeres are a much, if not the most, specialized group of birds, standing on the very topmost branch of the avian tree. Among them, therefore, the retention of archaic characters, though possible, would not be so likely as among some other groups. Besides, the arrangement of the oblique septa in them seems to be a secondary affair on account of the fact that the original (?) position of the attachment of those septa is indicated by rudiments varying in degree of the portion of the septa which was formerly inserted laterally and ventrally on to the sternum, and the Rook has these membranes complete. This may be in the form of a much-fenestrated membrane, or there may be but a single tag on each side near to the posterior margin of the sternum, or, as in an example of *Prosthemadera nove-zealandiae*, the attachment may have been completely retained on one side. I should be disposed, therefore, in spite of certain undeniable likenesses which the Passerines show to the Crocodilia, to regard the relations of the oblique septa in them as a modification of the more prevalent disposition of those parts.

In describing the septa of the somewhat aberrant Australian *Struthidea*, I called attention to the fact that the liver-lobes were partly shut off from the subomental space by membranous partitions. The exact way in which these partitions are related to the liver-lobes is, so far as my experience goes, unique among birds. But there are other birds in which an arrangement of the same kind exists; but with certain differences.

In several birds, for instance in *Chrysotis guildingi*, the left liver-lobe is completely shut off from the subomental space by a vertical transverse partition; there is no corresponding partition on the opposite side of the body. There are some birds in which, as in *Struthidea*, there are partitions on both sides; but in them the partitions are quite complete and entirely shut off the liver-lobes from the subomental space, not merely partially as in *Struthidea*.

<sup>1</sup> *Loc. cit.* p. 568.

<sup>2</sup> "On the Respiratory Organs in certain Diving Birds," P. Z. S. 1888, p. 256.

<sup>3</sup> "On the Subdivision of the Body-cavity in Lizards &c.," P. Z. S. 1889, p. 463.

This state of affairs I have found in certain Hornbills and in many Owls. At present I have not surveyed the principal groups of birds from this point of view; but some years since I described the same thing in a Penguin. Apart from this latter instance, which I hope to have the opportunity of re-examining, it is interesting to find a likeness between the Passeres and the Picarian birds, and between both and the Owls.

As to the homologies of this structure outside the Class Aves, I am inclined to liken it to what Mr. G. W. Butler has termed the "post-hepatic septum" in the Teiida. This structure, with which I am perfectly familiar from my own dissections, is a transverse septum which is attached to the ventral parietes, and nearly completely shuts off the liver-lobes from the rest of the abdominal cavity. In the Iguanida (*Iguana*, *Metopoceros*, *Phrynosoma*) there is apparently a trace of this post-hepatic septum in the shape of a membrane of limited extent which arises from the end of the right lobe of the liver, and is attached to the lateral parietes, forming thus a pocket shutting off the lung of that side of the body. In the Crocodile the membrane covering the liver, which represents a portion of the oblique septa, is reflected below the liver and separates it from the adjacent stomach; this is probably to be also looked upon as a representative of the structures mentioned.

5. A Note upon *Dissura episcopus*, with Remarks upon the Classification of the Hrodiones. By FRANK E. BEDDARD, M.A., F.R.S., Prosector to the Society, Examiner in Zoology and Comparative Anatomy to the University of London.

[Received January 13, 1896.]

As is well known, one of the main points of difference between the Ciconiida and the Ardeida is that the former possess the ambiens muscle, while the latter do not. But the late Prof. Garrod pointed out to this Society<sup>1</sup> some years since that this general rule is not without exceptions; for in *Xenorhynchus senegalensis* and *Abdimia sphenorhyncha* he discovered that the muscle so typical of the Storks was absent. Another point of difference between the Storks and the Herons is in the structure of the syrinx; in the Storks this modified region of the windpipe curiously resembles the syrinx of the tracheophone Passeres, while the Herons have a perfectly typical tracheo-bronchial syrinx. I found myself some years ago<sup>2</sup> that *Xenorhynchus senegalensis*, and more especially *Abdimia sphenorhyncha*, offered some points of likeness to the Herons in the structure of their syringes, which appeared to me to have some significance when correlated with the muscular peculiarity already referred to. In *Abdimia* (cf. fig. 2, p. 233),

<sup>1</sup> "Note on an Anatomical Peculiarity in certain Storks," P. Z. S. 1877, p. 711.

<sup>2</sup> "On the Syrinx in certain Storks," P. Z. S. 1886, p. 321.